



CITY OF TEMPE

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Confined Space Program



# Program Review

This program has been reviewed by the following City of Tempe employees.

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# Confined Space Program

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## Purpose

The intent of this Confined Space Entry Program is to provide guidance for entry into confined spaces for all City of Tempe employees. It establishes the minimum safe entry procedures into confined spaces. The development of this written Confined Space Entry Program is in accordance with Federal Occupational Safety and Health Regulations, 29 CFR 1910.146(c)(4). This program incorporates the standards established by the federal Occupational Safety and Health Administration in the "Permit Required Confined Spaces for General Industry; Final Rule" 29 CFR, Part 1910, Section 146.

This program provides standardized procedures to protect the health and safety of City of Tempe employees that work in or around confined spaces. The program constitutes the framework and format of the confined space entry program for all City employees, including temporary employees. The City requires its contractors, when working on construction projects on City-owned property or that involve entry by city employees (such as inspectors, project managers, etc.), to follow OSHA's Permit Required Confined Space Entry Program (§1910.146) and follow requirements defined in Chapter 14 of this document.

There are numerous OSHA standards that apply to most confined space entries. To ensure these concerns are addressed no space should be entered until an assessment is performed by the Program Administrator.

# Table of Contents

## **Introduction**

### **C H A P T E R 1**

#### **Roles and Responsibilities**

#### **Environmental Health & Safety Section**

#### **Department - Division**

#### **Confined Space Entry Coordinator**

#### **Supervisor**

#### **Employee**

#### **Location of Program**

### **C H A P T E R 2**

#### **Introduction**

#### **Definition Confined Space**

#### **Definition Permit Required**

#### **Signage Requirements**

#### **Manholes – Water Vaults**

#### **Communication – Electric**

#### **Reclassified Confined Spaces**

### **C H A P T E R 3**

#### **Program Requirements**

#### **Entry Permit**

#### **Entry Permit System**

#### **Posting Permit**

#### **Canceling Permit**

#### **Record Keeping**

#### **Annual Review of Program**

#### **Permit Review Team**

### **C H A P T E R 4**

#### **Training Requirements**

#### **Temporary Employees**

#### **Contractors**

### **C H A P T E R 5**

#### **Atmospheric Monitoring**

#### **Direct Meter Requirements**

#### **Limitations**

#### **Meter Training**

#### **Pre-Entry Monitoring**

#### **Verification Monitoring**

#### **Entry Monitoring**

#### **Acceptable Atmospheric Conditions**

#### **Other Instruments**

### **C H A P T E R 6**

#### **Personnel Duties**

#### **Supervisory Control**

#### **Entrant**

#### **Attendant**

### **C H A P T E R 7**

#### **Entry Procedures**

#### **Tripod Use**

#### **Change of Attendant**

#### **Retrieval Systems**

#### **Equipment Maintenance**

#### **Modification of Procedures**

### **C H A P T E R 8**

#### **Hazard Control**

#### **Isolation of Hazards**

#### **Lockout/Tag Out**

#### **Cleaning**

#### **Ventilation**

## **C H A P T E R 9**

### **Confined Space Hazards**

#### **Physical**

#### **Mechanical**

#### **Noise**

#### **Heat Stress**

#### **Vapor Density**

#### **Vapor Pressure**

#### **Hazardous Atmospheres**

#### **Toxic Atmospheres**

#### **Flammable – Explosive Atmospheres**

## **C H A P T E R 10**

### **Signs and Symptoms**

#### **Ammonia**

#### **Carbon Dioxide**

#### **Carbon Monoxide**

#### **Hydrogen Sulfide**

#### **Methane**

#### **Oxygen Deficiency**

#### **Perchloroethylene**

#### **Heat Disorders and Health Effects**

#### **Heat Rash**

#### **Heat Cramps**

#### **Heat Exhaustion**

#### **Heat Stroke**

## **C H A P T E R 11**

### **Classification Alternatives**

#### **Certification System**

#### **Certification System Requirements**

#### **Acceptable Atmospheric Conditions**

#### **Procedures for Certifying a Space**

#### **Signage for Certified Spaces**

#### **Reclassified Spaces**

#### **Procedures for Reclassifying Spaces**

#### **Signage for Reclassified Spaces**

#### **Entry Procedures for Certified Spaces**

#### **Entry Procedures for Reclassified Spaces**

## **C H A P T E R 12**

### **Tripod Use**

#### **Tripod Prohibited Use**

#### **Non-Entry Rescue**

#### **Rescue Teams**

## **C H A P T E R 13**

### **Hot Work Activates**

#### **Hot Work Procedures**

#### **Fire Watch Person**

#### **Prohibited Conditions**

## **C H A P T E R 14**

### **Contractors**

#### **City Requirements to Contractor**

#### **Contractor Responsibilities**

#### **Construction Projects**

## **H O T W O R K P E R M I T**

## **C O N F I N E D S P A C E P E R M I T**

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## Roles and Responsibilities

### EH&S Section

The Environmental Health and Safety Section (EH&S) will coordinate the establishment of the City's confined space entry program, administer the City's written Confined Space Entry Program, assess confined spaces as requested, provide training and perform all applicable record keeping requirements. For the purpose of this plan the **Industrial Hygienist** is the **Program Administrator**.

### Department Responsibilities

Each Department within the City is responsible for ensuring that the specific procedures regarding the safe entry into confined spaces with actual or potential hazards are properly followed. It is the responsibility of each Department to ensure that only properly trained City employees participate in the confined space entry program. Departments covered by this program will designate one person who will act as the Departmental **Confined Space Entry Coordinator (CSEC)**. More than one CSEC can be selected as determined necessary by the Department to ensure adequate oversight of Divisions and Sections. The Department will notify the Program Administrator of the name(s) of each of the CSEC and the area of oversight within thirty (30) days of initial implementation of this program and/or within seven (7) days of change in their CSEC. The Department CSEC will oversee this Program within his/her area of oversight with guidance from the Program Administrator and Environmental Health and Safety Section.

Each Department is responsible for identifying all confined spaces within their area of operations. Request for space evaluations will be made in writing to the Program Administrator.

Each Department is responsible for purchasing and maintaining the equipment required for safe entry into their specific sites as established by this program and any other applicable city health & safety programs. Each Department is responsible for seeing that the procedures for safe entry into confined spaces are properly followed during each entry operation.

Each Department is responsible for providing appropriate storage, maintenance, and inventory of all safety equipment. Equipment requiring routine maintenance and calibration must both be maintained and calibrated by the Department or sent back

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

for repair on a periodic basis for such services. Electronic equipment and regulators must be maintained and repaired by qualified individuals **ONLY**.

**CSEC  
Responsibilities**

Each CSEC is responsible for:

- Maintaining a file of their confined space hazard identification forms and cancelled entry permits;
- Conducting a review of the cancelled entry permits within two (2) days of cancellation;
- Forwarding (originals) cancelled permits to the program administrator within seven (7) days of cancellation;
- Reporting any occurrence of an unauthorized condition during entry operations to the Program Administrator and or EH&S Section.
- Informing the affected employees in their respective areas of any new permit space and/or any change of status (i.e. from permit-required to non-permit required).
- Communicating the information defined in Chapter 14 to contractors working in their specific areas.

**Supervisors'  
Responsibilities**

Supervisors will ensure that every employee has appropriate personal protective equipment required to safely perform their work assignments. They will identify employees in their work groups that have the potential to work in confined spaces. Supervisors are responsible for ensuring that only employees who have completed the required confined space entry training are allowed to participate in this program. Supervisors will conduct periodic checks (Document) of their work areas to make sure that employees are entering confined spaces in accordance with the City's Confined Space Entry Program procedures.

**Employees'  
Responsibilities**

Employees are expected to follow this program. Employees are responsible for properly using the safety equipment issued to them and ensuring that all equipment is in good working order before using it. Employees will use the required safety equipment in the correct manner, including testing, decontaminating, and storing the equipment.

Employees are required to promptly notify their supervisor of any hazardous working condition, and any improperly working safety equipment or instrument.

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

**Location and  
Availability of  
Program**

A copy of the written program is available for employee review from the administrative office of each department, from designated coordinators, or from the Environmental Health and Safety Section. The City will provide a copy of this written program to each employee involved in the City's confined space entry program during employee training.



## Intro to Confined Spaces

This program is established to protect the health and safety of City employees who perform work in or around confined spaces. The intent of this program is to provide standard procedures for the employees of the City of Tempe for safe entry into confined spaces. The City recognizes that working in or around permit-required confined spaces can involve significant health and safety hazards for employees and that this program is necessary to eliminate or control those hazards. This program establishes the minimum requirements for entry into confined spaces.

It is an unfortunate reality that workers continue to die in confined space accidents. An even sadder fact is that 65% of the people who die in confined space accidents are would-be rescuers: people who react to the situation but lack the proper training and skills necessary to perform safe rescue operations.

### Definition of a Confined Space

Confined spaces are a special type of hazard with which all workers and emergency response personnel need to be familiar. OSHA defines a confined space as any space that:

1. Has limited or restricted means for entry or exit; AND
2. Is large enough and so configured that an employee can bodily enter and perform assigned work; AND
3. Is not designed for continuous employee occupancy.

It is important to note that OSHA requires that **all** three conditions are present to meet its regulatory definition of a confined space. Spaces that do not meet all three of these conditions are not subject to OSHA's or the City's confined space entry program.<sup>1</sup>

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<sup>1</sup> It should be noted that there are spaces, which may not meet all three conditions, but present a significant health or safety hazard all the same. These spaces are still considered hazardous. Extreme caution should be exercised when working in or around these spaces.

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

Confined spaces are common in the majority of industrial settings. A few examples of confined spaces include, but are not limited to: storage tanks, manholes, sewer metering stations, pump station wet wells, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels, pipelines, and open top spaces, such as pits, basins, tubs, vessel vaults, and sumps.

**Definition of a  
Permit Required  
Space**

OSHA requires the City to evaluate its work places to determine if any confined spaces are permit-required confined spaces. A permit-required confined space (permit space) is a confined space that has one or more of the following characteristics:

- Contains or has a potential to contain a hazardous atmosphere, which include:
  - Oxygen deficient atmospheres;
  - Oxygen enriched atmospheres;
  - Flammable/explosive atmospheres;
  - Toxic; **OR**
- Contains a material with the potential for engulfment of an entrant; **OR**
- Has an internal configuration so that an entrant would be trapped or asphyxiated by inwardly converging walls, or a floor which slopes downward and tapers to a smaller cross-section; **OR**
- Contains any other recognized serious safety or health hazard (e.g., mechanical, heat, humidity, noise, electricity, moving parts of machinery, biological, fall hazards, etc.)

**Entry**

Entry into a confined space occurs as soon as ANY PART of the entrant's body breaks the plane of an opening into the space.

**Signage  
Requirements**

The City is required to inform employees of the presence of confined spaces, by posting signs or any other equally effective means (i.e. training), of the existence, location and danger posed by the permit spaces. When required, signs should read "Permit Required Confined Space – Do Not Enter." Other language may be used if pre-approved by the Program Administrator.

Each CSEC will maintain an inventory list of all the confined spaces identified in their specific area of responsibility. A copy of these inventories will be forwarded to the Program Administrator within **seven (7) days** of a change in their list and/or initial implementation of this program.

A yearly review of the spaces will be performed by the CSEC to ensure signs are in place where required.

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

**Manholes – Water  
Meter Vaults**

The City will utilize training to inform employees that **ALL** manholes (storm and sewer) and water meter vaults are hereby classified as permit-required confined spaces. Typical hazards that they pose will be identified during training. *Signs will not be required to be placed on manhole covers.*

**Communication  
Electric Vaults or  
Manholes**

Work groups that perform duties in Communication/Electric Vaults or manholes must contact the Program Administrator and request assessments of their individual spaces. These spaces present unique hazards and must be assessed by the Program Administrator to ensure compliance with all applicable OSHA standards.

**Certified Space**

This is a permit space in which the only hazard posed in the permit space is an actual or potential hazardous atmosphere, and that continuous forced air ventilation alone is sufficient to maintain the permit space safe for entry.

**Reclassified Space**

An existing permit-required confined space that does not contain actual or potential atmospheric hazards and all other hazards can be eliminated without entering the space may be reclassified as a non-permit space.

## Program Requirements

Since employees are required to enter confined spaces within the city to maintain the integrity of infrastructures and equipment, the City is required to have a written permit space program that complies with the requirements under §1910.146.

### Entry Permit

Prior to entry, the City must document the completion of the measures taken by preparing an entry permit and the entry supervisor must sign the permit to authorize entry **AFTER verifying that the entry permit is in order and the:**

1. Names of the attendant(s) and entrants are listed;
2. All actual and potential hazards have been identified;
3. All equipment necessary for safe entry is at the space and in good working order;
4. The time of atmosphere testing and is within acceptable entry conditions (if not, the appropriate personal protective equipment is identified and available for use), and
5. Emergency rescue procedures have been identified.

At the time of entry, the permit must be made available for review by all members of the entry team. Before any entry a pre-entry safety meeting must be conducted by the Entry Supervisor. **Post the completed permit at the confined space during entry.**

### Posting Permit

Posting the permit shall mean at the space in reach of the authorized attendant in such a manner as not to take the attendant away from his/her primary duties. If possible the Permit must be posted at the entrance or on the tripod.

### Entry Permit System

The use of the entry permit is the primary means of controlling entry into confined spaces. The duration of the permit is not to exceed the time required to accomplish the specific task listed on the permit. No permit shall remain open for over eight (8)

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

hours without receiving approval from the Program Administrator or representative from the Environment Health and Safety Section.

The entry permit is a pre-printed form that provides the following information:

1. Identification of the permit space and its physical location;
2. Specific purpose of the entry;
3. Name of the Authorized Entry Supervisor who authorizes entry;
4. Date and authorized duration of entry permit (the duration does not necessarily need to be stated in time, but can be stated in terms of the completion of a specific task);
5. Entrants, by name;
6. Attendant(s), by name;
7. Known and potential hazards of the space;
8. Specific measures used for isolating the permit space and for removing or controlling hazards. **These can include the lockout or tagging of equipment and procedures for purging, inerting, ventilating, and flushing permit spaces;**
9. Conditions under which entry is permitted (acceptable entry conditions);
10. Atmospheric testing and monitoring results which are required before and during entry (along with signature or initials of the person performing the testing, an indication of when the tests were performed and when and by whom the instrument was calibrated);
11. Rescue and emergency services that can be summoned and the means for summoning those services;
12. Equipment required on site to safely perform the entry operations or rescue the entrants without having to enter the space. This includes such items as:
  - Personal protective equipment (gloves, hard hats, chemical protective clothing, safety glasses, respirators, etc.);
  - Communications equipment;
  - Atmospheric monitors with audible and visual alarm systems; and
  - Rescue equipment (full-body harness, tripod with mechanical winch).
13. Communication procedures used by Attendants and Entrants to remain in contact during entry;
14. Any special circumstances involved or other information relating to a particular permit space that is necessary to ensure employee safety, such as traffic control equipment; and
15. Any additional permits, such as for hot work (welding, grinding or any other work which can generate a source of ignition), that have been issued to authorize work in the permit space.

**Canceling Permit**

Any member of the entry team can terminate entry operations. The authorized entry supervisor **must** cancel the permit (by signature) upon completion of entry operations or if conditions not identified in the permit are encountered. Problems

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

encountered during the entry operations must be documented in the comment section on the back of the entry permit.

**Record Keeping**

The City is required to maintain a copy of the entry permit for one year to facilitate the mandated annual review of this program. Completed (Originals) permits will be submitted to the Program Administrator within seven (7) days of cancellation of the permit.

**Annual Program Review**

The Program Administrator is required to review entry operations and revise the confined space entry program at least annually or whenever there is any reason to believe that measures taken are inadequate to protect employees. The Program Administrator is required to conduct this review of the confined space entry program, using canceled permits, within one year of each entry and revise the program as necessary. Examples of circumstances requiring the review of the permit space program include but are not limited to:

- Any unauthorized entry of a permit space,
- Detection of a permit space hazard not covered by the permit,
- Detection of a condition prohibited by the permit,
- Occurrence of an injury or near-miss during entry,
- Entrants not obeying the attendant or following entry permit requirements (e.g., failing to properly use specified safety equipment or follow safe entry procedures);
- Change in the use or configuration of a permit space, and
- Employee complaints about the effectiveness of the program.

**Permit Review Team**

The Permit Review Team is comprised of the CSEC from the various Departments within the City of Tempe. The Program Administrator may include others to this team. Each Department's CSEC will maintain a copy of each canceled confined space entry permit for their specific area and conduct a review of their canceled permits.

The Permit Review Team will meet as determined necessary by the Program Administrator to review entry permits, which were canceled as a result of any of the following:

- Unacceptable entry conditions;
- New hazard arose during entry; or
- Change in entry operations occurred.

The Permit Review Team will conduct a yearly review of the existing confined space safe entry procedures and the written confined space entry program. The Program Administrator will notify the representatives of the time and place of review meetings.

## Training Requirements

The City is required to provide training to all employees who may be involved in confined space entry operations. **Each Department will ensure that employees receive training:**

- Prior to the first assigned confined space entry duties;
- Before there is a change in assigned duties;
- Whenever there is a change in confined space operations; and
- Whenever the City believes that the employee's knowledge of proper procedures is inadequate.

Training will be used to establish employee proficiency in proper confined space entry procedures. The Program Administrator will approve training programs as they relate to this program. All approved training shall be documented and must include the employee's name, signature or initials of the trainers, and the dates of the training. This documentation must be available for inspection by employees or their authorized representatives.

### Training

Training for employees expected to operate in confined, permit required, reclassified or certified spaces shall include training in the requirements of this program. The following types of training are required:

- Awareness Level

Any employee who will be working in areas where confined spaces are identified. Employees will demonstrate competencies in confined space identification and hazard awareness. These employees will not participate in Permit required confined space entries.

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

- Operations Level

Any employee who will participate as an Entrant, Attendant or Authorized Supervisor will receive this training. Employees will demonstrate competencies in confined space identification, personal protective equipment, hazard identification, atmospheric monitoring and job duties.

- Specialized

These are employees who specialized in high risk entries that required additional equipment and training to safely perform an entry. Employees that will be considered Specialized by this program include:

- Tempe Fire Department
- Tempe Police Department – SIB
- High Risk Entry Teams as defined by the Program Administrator

The Program Administrator must be notified of all employees considered to be specialized and approve all training (*Exception TFD*). Records of training will be maintained by the CSEC and will be available upon request by the Program Administrator.

**Temporary  
Employees**

Temporary employees, **including interns**, working in City-owned spaces are to receive a confined space “awareness-level” training prior to initiating work around confined spaces to increase their comprehension of the hazards of confined spaces. **Temporary workers are prohibited from performing work in permit-required confined spaces.** Temporary employees that have received the confined space awareness training may work in certified spaces or in re-classified spaces under the direct supervision of trained AES, attendant or authorized entrant. Prior to commencing work in a certified or re-classified space the Program Administrator must be notified by the CSEC responsible for the temporary employees.

**Contractors**

The City requires its contractors, when working on construction projects on City-owned property, to comply with 29 CFR Part 146 and the employee training requirements listed in the standard. **See Chapter 14** for additional contractor requirements.



## Atmospheric Monitoring

Atmospheric monitoring of a confined or permit required space is one of the single most important safety precautions. Failure to properly monitor a confined or permit required space may result in serious injury or death. All confined spaces will be monitored. If the space is a reclassified/certified space see Chapter 11 for specific requirements. For all entries a direct read instrument will be used. These meters are only capable of detecting gases and vapors presented to the sensors. Other monitoring equipment may be used as determined necessary by the Program Administrators' assessment.

### Direct Read Meter

Atmospheric monitoring will be performed using a four (4) sensor (minimum) direct read instrument. At present, only MSA® Five Star and Passport meters are approved for use in City of Tempe confined spaces. Meters will be serviced and calibrated monthly by certified MSA technicians. Meters will be downloaded and reviewed to identify peak readings to ensure integrity of the sensors. If an occurrence of a PEL, TWA or IDLH is recorded; the Program Administrator will be notified. Records will be maintained electronically for a minimum of one year.

### Limitations

It is important to remember that the MSA direct read meter used by the City of Tempe will only detect gases and vapors in air only. The meters **cannot** detect the following:

- Presence of combustible airborne mists such as lubricating oils; or
- Combustible airborne dusts such as grain or coal.

**DO NOT measure combustible gases or vapors in oxygen deficient or enriched environments.**

### Direct Read Training

Only employees who have been trained in the use of monitoring equipment may use monitoring equipment. All meters will be used in accordance with manufactures requirements. Meters will be "Bump Tested" and "Field Pump Tested" prior to use. Records of the Bump Test will be maintained for a minimum of one year.

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

**Space Monitoring**

Atmospheric monitoring will be performed around the opening of the space before it is opened. When monitoring potentially stratified spaces, the space will be monitored in the direction of travel at a maximum of four (4) foot intervals. Sufficient time must be given to allow the sensors to read the atmosphere (When using a sample pump, sample line and probe, allow 0.3 feet per second.)

**Pre-Entry  
Monitoring**

Atmospheric monitoring will be performed to verify the space is within acceptable entry conditions prior to entry. The time, date and results of the monitoring will be recorded on the permit. All members of the entry team may be present to verify readings.

**During Entry**

Atmospheric monitoring will be continuous in nature. The Authorized Entrant will maintain the meter in his/her breathing zone at all times during entry. Readings will be recorded by the Authorized Attendant on the permit when taken. Monitoring of individual spaces is to be determined by the Entry Supervisor to ensure the safety of the Entrant(s). However, readings are required to be taken at least every 15-minute.

At no time will the meter be removed from the space while Entrant(s) are in the space. Anytime there is a change in atmospheric readings it will be recorded on the permit.

**Acceptable  
Atmospheric  
Conditions**

Oxygen	19.5% to 23%
LEL	<10%
Carbon Monoxide	<35 ppm
Hydrogen Sulfide	<10 ppm
Chlorine	<1.0 ppm

**Other Instruments**

When other means of measurement are needed to verify safe entry conditions the Program Administrator must be contacted and an additional assessment of the space will be conducted.

## PERSONNEL DUTIES

OSHA regulations identify the specific roles in confined space entry operation: authorized entrants, attendants, and entry supervisor. The responsibilities and the specific duties for each are summarized below.

### **Supervisory Control**

The **Authorized Entry Supervisor<sup>2</sup>**, or **AES**, is responsible for:

- Determining if acceptable entry conditions are present at a permit space where entry is planned;
- Authorizing entry operations; and
- Terminating entry as required by the Standard.

The AES will ensure that: a permit is issued for each confined space entry; that all of the known or suspected hazards have been identified; appropriate measures to eliminate or control the hazard have been implemented; communication system has been established; and non-entry rescue equipment is used (such as full-body harness with retrieval line attached to a tripod).

**Employees must be in good health and have received training specified in this program, which will enable them to acquire the knowledge and skills necessary for safe performance of duties. The use of respirators requires medical clearance and additional training in accordance with the City of Tempe, Respiratory Protection Program.**

It is the duty of the designated AES to:

1. Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and the consequences of the exposure;
2. Verify that the permit is complete, all required tests have been conducted, and all necessary procedures are in place before endorsing (by signing) the permit and allowing entry to proceed;

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<sup>2</sup> An entry supervisor also may serve as an attendant or as an authorized entrant, as long as that person is trained and equipped as required by this program for each role he or she fills. Also, the duties of the entry supervisor may be passed from one individual to another during the course of the entry operations. All changes personnel duties are to be noted on the entry permit. The atmospheric conditions should also be noted on the permit at the time of any change in duties.

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

3. Terminate the entry and cancel the permit as necessary;
4. Authorize entry to begin or allow entry operations that are already underway to continue;
5. Verify the availability of rescue services and that the means to contact them are operable;
6. Remove unauthorized individuals that enter or attempt to enter the space; and
7. Determine if entry operations remain consistent with permit requirements and acceptable entry conditions have been maintained, especially when responsibility for a permit space entry operation is transferred and at intervals dictated by the hazards and operations performed in the space (such as atmospheric monitoring frequencies).

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**Where acceptable entry conditions are not present, the AES must prohibit entry or, if entry is already underway, order the Authorized Entrants out of the permit space and cancel the entry permit.**

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**Authorized  
Entrants**

An authorized entrant is a City of Tempe employee who works inside permit spaces and who has received the necessary training to acquire the understanding, knowledge, and skills necessary for the safe performance of the duties assigned below. It is the responsibility of the Entrants to:

1. Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and the consequences of the exposure;
2. Read and understand the contents of the permit;
3. Properly use the equipment required for the confined space entry (such as the proper use and operation of the gas detector);
4. Communicate with the Attendant as necessary to enable the Attendant to monitor the Entrant's status and to enable the Attendant to alert the Entrants should there be a need to evacuate the space;
5. Alert the Attendant whenever:
  - Any warning sign or symptom of exposure to a dangerous situation is detected, or
  - A prohibited condition is detected; and
6. Exit the permit space as quickly as possible whenever:
  - An order to evacuate is given by the Attendant or AES;
  - The Entrant recognizes any warning sign or symptom of exposure to a dangerous situation;
  - The Entrant detects a prohibited condition; or
  - An evacuation alarm is activated, such as the gas detector alarm.

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

**Attendant**

The attendant is the individual stationed outside the permit space who monitors authorized entrants and who performs all of the duties outlined below. It is the responsibility of the Attendant to:

1. Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and the consequences of the exposure, especially behavioral effects of hazard exposure in authorized entrants;
2. Monitor entrants, maintaining an accurate count, of all entrants in the space ensuring that they have been accurately identified on the permit;
3. Remain outside the entrance to the permit space during entry operations until relieved by another Attendant;
4. Communicate with the Entrants as necessary to monitor their status and to alert them to the need to evacuate the space if necessary;
5. Monitor activities inside and outside the space to determine if it is safe for Entrants to remain in the space and order the Entrants to evacuate the permit space immediately if following conditions arise:
  - A prohibited condition,
  - Entrants exhibit the behavioral effects of hazard exposure,
  - A situation outside the space could endanger the Entrants, or
  - The Attendant cannot effectively and safely perform all of the duties listed under this section;
6. Summon rescue and other emergency services as soon as it is determined that the Entrants may need assistance to escape from the permit space;
7. Prevent unauthorized personnel from approaching or entering a permit space by:
  - Warning the unauthorized persons that they must stay away from the permit space,
  - Advising unauthorized persons that may have entered the space to immediately leave the space, and
  - Informing the authorized entrants and AES if unauthorized persons have entered the space;
8. Perform non-entry rescues specified by the City's rescue procedures, such as using the rescue winch tripod; and
9. Perform no other duties that might distract from or interfere with the Attendant's primary duty to monitor and protect the Entrants.
10. Ensure that all Entrants are only doing work specifically identified on the permit and in accordance with safe work procedures.

## ENTRY PROCEDURES FOR PERMIT SPACES

The following procedures are provided for the safe entry into permit spaces. Its purpose is to provide general guidance for employees that work in or around confined spaces. For this confined space entry program to be effective, it is necessary for you to read and become familiar with the following permit space entry procedures. However, these procedures may not cover all safety precautions or hazard control procedures associated with every confined space entry.

### Pre-Entry Procedures for Permit Space Entry (Off-site):

- Review Site Hazard Identification form for confined space site;
- The AES obtains and fills out a Confined Space Entry Permit. The AES will identify the following information on the permit:
  - Identity and location of the permit space;
  - Purpose of the entry (be specific);
  - Date and authorized duration of the entry permit;
  - Name of the AES;
  - Name of the Attendant(s);
  - Name(s) of the Authorized Entrants;
  - All actual and potential hazards present of the confined space;
  - Specify the isolation measures necessary to eliminate or control the hazard(s) prior to entry;

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

- Acceptable entry conditions<sup>3</sup> (pre-listed on the backside of the permit). If entry is required into confined spaces with toxic or oxygen deficient atmospheres, then the appropriate level respiratory protection will be listed on the permit. Only qualified employees<sup>4</sup> are permitted to work in toxic or oxygen deficient hazardous atmospheres.
- Equipment required for safe entry (such as traffic barricades, mechanical ventilation, all safety equipment, ladders, tripod with full body harness, approved lighting, etc.);
- Rescue and emergency procedures and the means for summoning those services (Emergency phone numbers are listed on the backside of the entry permit).
- Communication procedures to be used between the authorized entrants and the attendant to maintain contact during the entry; and
- If any additional permits are required (e.g., Hot Work Permit).
- The AES will ensure that the equipment necessary for safe entry is available and in good working order.

**Tripod Use**

See Chapter 12

**Pre-Entry Procedures at the Permit Space**

- Monitor atmosphere around opening of the permit space prior to removing cover or opening space (if possible);
- Open entrance to space or remove cover. Place barricading around the space to **secure the space** and prevent unauthorized entry (eliminate potential fall hazard);
- Conduct internal atmospheric monitoring to ensure acceptable entry conditions are present.
- Enter atmospheric monitoring results on the permit (include name of person conducting the monitoring, type of meter used and most recent calibration date of the meter). **REMEMBER TO MONITOR THE ATMOSPHERE AT VARIOUS LEVELS WITHIN THE SPACE TO DETECT STRATIFIED GASES;**

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<sup>3</sup> Entry into flammable/explosive (>10% LEL) or oxygen enriched (>23.5% O<sub>2</sub>) atmospheres is prohibited.

<sup>4</sup> For the purpose of this program, a qualified employee is an employee who has successfully completed their medical evaluation, quantitative fit test, employee respiratory protection training, SCBA use and care training and has demonstrated competency in the proper use of an SCBA.

**CITY OF TEMPE**  
**CONFINED SPACE PROGRAM 2004**

- If conditions are not acceptable such as high hydrogen sulfide levels (>10 ppm) or low oxygen levels (<19.5% O<sub>2</sub>), ventilate the space, using natural or mechanical ventilation, for a predetermined amount of time and re-test the atmosphere.

If conditions are still unacceptable, either:

1. Increase ventilation time or switch from natural to mechanical ventilation;
  2. Require the use of appropriate personal protective equipment (such as an SCBA); or
  3. Terminate entry operations and cancel entry permit.
- Note the presence of unacceptable entry conditions and the steps taken to obtain acceptable conditions on the Comment Section located on the back of the entry permit.
  - Set-up and test necessary equipment (barricades, tripod, communications, etc.);
  - Once acceptable entry conditions have been obtained **OR** the PPE necessary for safe entry has been identified and is present at the site as well as all other equipment necessary for safe entry is in-place, the AES will sign the permit authorizing entry operations to begin.
  - The Attendant will review the permit to verify that acceptable entry conditions have been obtained **OR** the PPE necessary for safe entry has been identified and is present at the site as well as all other equipment necessary for safe entry is in-place, then signs the permit;
  - The authorized Entrants will review the permit to verify that the acceptable entry conditions have been obtained **OR** the PPE necessary for safe entry has been identified and is present at the site as well as all other equipment necessary for safe entry is in-place, then signs the permit.
  - The entry permit is required to be at the entrance to the permit space throughout the duration of the entry operation.



**Entry Procedures at the Permit Space**

- Authorized Entrants will only conduct the work operations that are specifically identified on the entry permit. The introduction of work operations other than those listed can result in the generation of additional hazards for which protective measures have not been identified nor implemented and **is prohibited**.
- The atmospheric conditions within the space are to be continuously monitored throughout the course of entry operations. A personal atmospheric monitor worn by the authorized entrants is the preferred method especially when work operations occur away from the entrance to the space.

Periodic **(Maximum of 15-Minutes Refer to Section 5)** atmospheric measurements are to be entered on the entry permit. The quantity of measurements will vary from space-to-space. If conditions remain constant throughout the duration of the entry. Any atmospheric changes shall be noted on the permit.

- The appearance of an unacceptable entry condition during entry operations will terminate entry operations and result in the cancellation of the entry permit. The unacceptable entry condition is to be noted on the canceled permit.
- The AES or the Attendant will, upon completion of entry operations, cancel the permit by signing it at the appropriate place on the back of the permit.
- The occurrence of an unacceptable entry condition or any other unforeseen incident is to be noted on the Comment Section of the permit.
- Forward a copy of the completed/canceled entry permit to the Program Administrator.

**Change of  
Attendant**

Whenever there is a change in Attendants, the atmospheric readings and time of the reading will be noted on the entry permit. This is to verify that the acceptable entry conditions are still present at the time of the change in Attendants.

**Retrieval Systems**

See Chapter 12

**Equipment  
Maintenance**

Tripods, pulleys, harnesses, cables and ropes shall be inspected and maintained as recommended by the manufacture. Records of inspection and maintenance shall be maintained by each CSEC for the life of the equipment and be available upon request by the Program Administrator. All equipment used for hoisting individuals shall have a man rating.

No home made equipment will be used.

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

**Modification – Site  
Specific  
Procedures**

Modifications of any portion of this plan, including more stringent requirements, must be reviewed and approved by the Program Administrator before they are used (*Exception: Sworn Tempe Fire Department Personnel*). This is to insure consistency with all employees operating under this plan.

## HAZARD CONTROL

Most confined spaces have hazards. However, most of these can be mitigated, if not completely eliminated by employing established safety procedures. Once the hazards have been identified, determining the routes of exposure will enable the AES to identify the personal protective equipment and isolation measures necessary to protect the Entrants. These procedures include isolation of hazards, retrieval lines, warning signs, barriers and mechanical ventilation.

### Isolation of Hazards

Isolation is the process by which a permit space is removed from service and completely protected against the release of hazardous energy and material in the space. This is accomplished through:

- **Blanking or Blinding** - results in the absolute closure of a pipe, line, or duct by the fastening of a solid plate (such as a skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate;
- **Misaligning or removing** sections of lines, pipes, or ducts;
- **Double block and bleed system** - the closure of a line, duct, or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves; and
- **Blocking or disconnecting** all mechanical linkage.

### Lockout/ Tag out

Lockout/Tag out refers to the process of shutting off and locking out of all potential sources of energy to the specified area. These sources of energy are not limited to electricity, but include hydraulic, pneumatic, and mechanical energy sources. The requirements are specified in 29 CFR 1910.147 OSHA's "Control of Hazardous Energy Sources."

The purpose of this requirement is to prevent accidental activation of equipment while workers are in close contact with equipment.

## Cleaning

Once the space has been isolated, it may need to be cleaned, purged, tested and ventilated.

- **Purging / Inerting**

There are three basic steps involved in purging/inerting a confined space:

1. The confined space is emptied and all residue is drained or pumped out;
2. The confined space is rinsed or flushed out;
3. The confined space is purged using steam, nitrogen, dry ice or an inert gas.

Care should be taken when purging a confined space since this will result in the displacement of oxygen, creating an atmospheric hazard - **oxygen deficient atmosphere**. When inerting, all access points/portals should be barricaded and properly signed to prevent unauthorized access.

## Ventilation

This is one of the most effective ways of eliminating an atmospheric hazard. It can provide clean, breathable make-up air to replace contaminated air removed from the space. The location of the exhaust and inlet are important.

- The service of the make-up air must be clean and contain a sufficient concentration of oxygen.
- **NEVER use pure oxygen as a source of make-up air.** It can create an oxygen-enriched environment that is a flammable/explosive hazard.
- The make-up air should not be located near the exhaust outlets or near any other exhaust systems (i.e., near an idling vehicle or generator).

Always follow the manufacturer recommendations for using mechanical blowers. The units are rated at a flow rate (cubic feet/min) based on a specific length of hose. Do not attempt to increase the hose length; it will decrease the air volume. Each time the hose is bent, twisted or kinked, it decreases the flow volume.

## CONFINED SPACE HAZARDS

There are several different types of hazards that can be found in confined spaces. Typical confined space hazards include atmospheric (toxic, oxygen deficient, flammable, etc.), fall, environmental (heat, cold, humidity), light/visual, noise, biological (poisonous animals and insects) and mechanical/physical. Hazards can also result from the environment around the confined space (traffic hazards) or from work performed in the confined space (such as hot work, paint stripping, sand blasting, etc.)

The three most deadly types of hazards are physical, mechanical and atmospheric. Fortunately, all of these hazards can be eliminated or controlled when they are properly identified **before** entry begins.

### Physical

Physical hazards include general workplace hazards and engulfment. Examples of general workplace hazards include noise, falling objects, slick surfaces, temperature extremes (including humidity), and fall and trip hazards. Engulfment refers to situations in which a worker becomes trapped or enveloped by a material, usually a dry bulk material such as sand or wheat. The primary hazard is asphyxiation, caused either by the material filling the victim's respiratory system as it is inhaled or through compression of the torso by the engulfing material. Other hazards include thermal or chemical burns resulting from direct contact with the material itself.

### Mechanical

Mechanical hazards are present when there is a possibility of moving machinery causing injury to personnel in close proximity. A person that becomes entangled in moving machinery can suffer injuries such as crushed and lacerated limbs, severed limbs or even death.

### Noise

Noise exposure can cause serious hearing damage and is to be treated as any other work place hazard. The degree of hazard posed by noise depends on three factors, (1) Length of exposure time, (2) Force of the sound waves (loudness) and (3) Frequency (pitch) of the sound.

High noise levels can distract the worker and make it difficult for Entrants to hear alarms on direct-reading atmospheric monitors. Atmospheric monitors should be equipped with both audible and visual alarms.

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

It can also interfere with the Entrants ability to communicate with each other or the Attendant. Alternative modes of communication such as hand or rope signals should be developed prior to entering the space. Entrants should practice these signals to ensure that they will be able to communicate effectively.

**Heat Stress**

Many permit spaces expose workers to high temperatures or require the use of chemical protective clothing that inhibits the body's ability to properly regulate its internal temperature. Since heat rises, this hazard can be greater at the upper levels of the space. In addition, high humidity, respirators, gloves and other protective equipment can increase the effects of heat. **See Section 10 for the Sign & Symptoms of Heat Disorders.**

**Vapor Density**

Each vapor has a density; the ratio of mass to the unit of volume, vapor density. It is the measurement of the weight of a vapor as compared to an equal volume of air. Air is equal to one (1). A density of less than one (1) is said to be lighter than air which will rise where as a vapor density greater than 1 is heavier than air and tends to settle in low lying areas and pockets. Vapor density of the substance will enable the worker to identify where in the space the substance may accumulate. This is an important consideration when testing the space.

The vapor density may not be listed in any of the reference documents. It may, however, be expressed as the molecular weight (MW) of the substance. The reference standard for air using the MW is roughly 29. In the NIOSH guidebook under "Chemical and Physical Properties", benzene has a MW of 78.1. Since the MW of benzene is greater than air, then the substance benzene is heavier than air. It would be expected to accumulate in lower areas.

**Vapor Pressure**

Vapor pressure is the property that determines how easily a substance will evaporate – or release vapors. The higher the pressure the more easily a substance will evaporate. It is also the pressure exerted by the molecules of a liquid leaving the liquid and entering an empty space. In this definition, the units are typically expressed in mmHg or psi. The atmospheric pressure at sea level is 760 mmHg (or 29.92 inches of Hg or 14.7 psi - all at sea level). Increasing the vapor pressure will result in an increase in the concentration of the chemical in the air.

It is important to note that increased temperatures applied to a closed container will cause the vapor pressure to increase. Leaving a closed, flammable drum outside in the summer will cause it to bulge and eventually resulting in a **BLEVE** (Boiling Liquid Expanding Vapor Explosion).

**Hazardous  
Atmospheres**

The safest air to breathe in a confined space is one that is most similar to normal air. The human senses (sight, smell, and taste) cannot protect workers from hazardous atmospheres. Some gases have no taste or odor or can cause olfactory fatigue (hydrogen sulfide), others are lethal at concentrations below their odor threshold.

**Remember - If you can smell it, you've already been exposed to it!** Detection of these hazardous atmospheres requires the use of electronic monitoring devices.

Atmospheric hazards result from chemical substances present in the space. Many chemical substances exhibit multiple hazards in confined spaces, depending on the concentration present. For example, methane (CH<sub>4</sub>) forms a flammable/explosive atmosphere when mixed with air in a concentration of 5-15 percent by volume. Methane is normally non-toxic; however, in high concentrations, it can displace oxygen and form an asphyxiating atmosphere. Other chemical substances commonly found in confined spaces include carbon monoxide (CO), hydrogen sulfide (H<sub>2</sub>S) and carbon dioxide (CO<sub>2</sub>).

Atmospheric hazards are categorized into three groups: asphyxiating/oxygen deficient atmospheres, toxic atmospheres, and flammable/explosive atmospheres. It also possible for a space to have a combination of all three of these atmospheric hazards.

**Toxic  
Atmospheres**

Certain airborne chemicals (gases, vapors, mists and dust particles) may have a toxic effect on unprotected workers entering a confined space. While the human respiratory system is able to tolerate limited exposures to toxic gases, vapors, and particulates, care must be taken to eliminate or control these hazards. An atmosphere is considered hazardous if the atmospheric concentration of any substance exceeds its published Permissible Exposure Limit (PEL).

If a substance does not have a PEL, then other sources such as ACGIH, NIOSH or the Material Safety Data Sheets (MSDS) should be used as guidance in determining dangerous concentrations. Carbon monoxide and hydrogen sulfide are the most commonly encountered toxic gases in confined spaces. It is important to remember that many chemicals, because of their properties, are both asphyxiating and toxic.

**Explosive  
Flammable  
Atmospheres**

Confined spaces are ideal places for flammable gases to collect. Combustible dusts are also a potential problem in confined spaces. OSHA considers an atmosphere to pose a serious fire or explosion hazard if a flammable gas or vapor is present at a concentration greater than 10 percent of its Lower Explosive Limit (LEL, also referred to as Lower Flammable Limit or LFL).

# Chapter 10

## **SIGNS & SYMPTOMS OF EXPOSURE**

The basic duty required of authorized Entrants, Attendants and Entry Supervisor is to be able to recognize hazards, including the mode, signs or symptoms, and consequences of exposure.

- Know the hazards faced during entry, including information on the mode of exposure (exposure routes);
- Recognize the signs or symptoms of exposure; and
- Understand the consequences of exposure to the hazards.

If the employee has properly identified all of the actual or potential hazards that will be present in the confined space and if a MSDS for that substance is required to be at the workplace by the Hazard Communication Standard (§1910.1200), information concerning that substance, including its mode of action, will be readily available for all personnel involved in the permit space entry. When an MSDS is available, it will be included as an attachment to the permit.

OSHA believes that requiring attendants to be aware of possible behavioral effects of hazard exposure will alert Entrants and Attendants to the important aspects of safe confined space entry operations. Subtle behavioral changes detected in the entrants speech or deviation from set communication procedures can alert the attendant that a hazardous condition is present and the entrant needs to evacuate the space or be rescued. Some of the possible atmospheric exposures that may be encountered in confined spaces are listed below:



**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

**Ammonia**

The substance is corrosive to the eyes, the skin, and the respiratory tract. Inhalation of high concentrations may cause lung oedema. Rapid evaporation of the liquid may cause frostbite. Burning sensation. Cough. Labored breathing. Shortness of breath. Sore throat. Medical observation is indicated.

NH<sub>3</sub>



REL 25 TWA ppm

PEL 50 ppm

IDLH 300 ppm

VD 0.60 (Lighter than Air)

**Carbon Dioxide**

The gas is heavier than air and may accumulate in low ceiling spaces causing deficiency of oxygen. Build up of static electricity can occur at fast flow rates and may ignite any explosive mixtures present. Free-flowing liquid condenses to form extremely cold dry ice. Inhalation of high concentrations of this gas may cause hyperventilation and unconsciousness. Rapid evaporation of the liquid may cause frostbite. The substance may have effects on the metabolism.

CO<sub>2</sub>



REL 5000 TWA ppm

PEL 5000 ppm

IDLH 40,000 ppm

VD 1.53 (Heavier than Air)

**Carbon Monoxide**

This is an odorless, colorless gas typically generated by combustion. The substance may cause confusion, dizziness and nausea. Will affect the blood, cardiovascular system and central nervous system. Exposure at high levels may result in lowering of consciousness and death. Medical observation is indicated. The substance may have effects on the nervous system and the cardiovascular system, resulting in neurological and cardiac disorders. Suspected to cause reproductive effects such as neurological problems, low birth weight, increased still births, and congenital heart problems.

CO



REL 35 TWA ppm

PEL 50 ppm

IDLH 1200 ppm

VD 0.97 (Lighter than Air)

### Hydrogen Sulfide

Sense of smell becomes rapidly fatigued & can NOT be relied upon to warn of the continuous presence of  $H_2S$ . Colorless gas with a strong odor of rotten eggs. Irritation eyes, respiratory system; apnea, coma, convulsions; conjunctivitis, eye pain, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light), corneal vesiculation; dizziness, headache, fatigue, irritability, insomnia; gastrointestinal disturbance. Symptoms may be delayed. Rapid evaporation of the liquid may cause frostbite. The substance may cause effects on the central nervous system. Exposure may result in unconsciousness. Exposure may result in death. The effects may be delayed. Medical observation is indicated.

$H_2S$



REL 10 (C) ppm

PEL 20 (C) ppm

IDLH 100 ppm

VD 1.19 (Heavier than Air)

### Methane

This is an odorless, colorless compressed or liquefied gas. The substance is extremely flammable. Is a simple may cause confusion, dizziness and nausea. Will affect the blood, cardiovascular system and central nervous system. Exposure at high levels may result in lowering of consciousness and death. Medical observation is indicated. The substance may have effects on the nervous system and the cardiovascular system, resulting in neurological and cardiac disorders. Suspected to cause reproductive effects such as neurological problems, low birth weight, increased still births, and congenital heart problems.

$CH_4$



REL -- TWA ppm

PEL -- ppm

IDLH -- ppm

VD 0.60 (Lighter than Air)

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

**Oxygen Deficiency**

Is caused by displacement by other gases, bacterial decay, chemical reactions that use oxygen such as rusting, absorption, combustion, burning and welding.

$O_2$



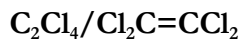
**Oxygen Level**

**Symptoms**

15 – 19%	Loss of muscular coordination, could impede self rescue.
12 – 14%	Rapid breathing and pulse. Impaired judgment/coordination.
10 – 12%	Further increase of respiration/pulse.
8 – 10%	Fainting, nausea, vomiting, blue lips.
6 – 8%	4 -5 minutes of exposure = recovery with treatment 6 minutes = 50% fatal 8 minutes = 100% fatal
0 – 6%	Coma in 45 seconds or less. Death

**Perchloroethylene**

Used by dry cleaners. Irritation of the eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; vertigo (an illusion of movement), dizziness, in coordination; headache, somnolence (sleepiness, unnatural drowsiness); skin erythema (skin redness); liver damage; [Potential occupational carcinogen]. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the central nervous system. Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the liver and kidney. Tumors have been detected in experimental animals but may not be relevant to humans



REL 5000 TWA ppm      PEL 100 ppm      IDLH 150 ppm

VD 1.62 (Heavier than Air)

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

**Heat Disorders and  
Health Effects**

Working outside during the summer months exposes workers to serious health hazards that can cause permanent damage or death. Extreme caution must be exercised by entry team members who have to enter a confined space. Scheduling entries in the early morning should be considered for every entry. Employees should be allowed to acclimate to the heat. If an employee is on vacation or off for even a few days, they should be given several days to acclimate themselves before working in the heat.

Departments should ensure that employees receive training each year that informs affected employees on the hazards of working in hot environments. The following are stages of heat disorders, in increasing severity.

**Heat Rash**

Heat rashes are common in the work environment. “Prickly” heat appears as red papules, usually in areas where the clothing is restrictive. Occurs when skin that is persistently wetted by unevaporated sweat. Heat rash papules may become infected if not treated. In most cases the rash will disappear when the affected individual returns to a cool environment.

**Heat Cramps**

Heat cramps commonly result from performing hard physical work in a hot environment. These cramps are attributed to the continued loss of salt that occurs during sweating. Cramps can be alleviated by resting and drinking water. Salt tablets **should not be used**. Drinking lots of fluids the day before the activity will decrease the potential for heat cramps. Frequent rest breaks and fluid is high encouraged during hot times of the year. Sports drinks may be taken but should not replace water entirely.

**Heat Exhaustion**

The symptoms are headache, nausea, vertigo, weakness, thirst, and giddiness. Responds readily to prompt treatment. Heat exhaustion should not be dismissed lightly. Fainting can be associated with heat exhaustion, which can be dangerous if the victim is operating machinery or injures themselves during the fall. Symptoms are similar to heat stroke, which is a medical emergency. Workers suffering from heat exhaustion should be with removed from the source of heat, provided with fluid and rest.

**Heat Stroke**

Heat stroke occurs when the body’s system of temperature regulation fails and the body’s temperature rises to critical levels. The primary symptoms

- Confusion;
- Irrational behavior;
- Loss of consciousness;
- Convulsions;
- Lack of sweating
- Hot, dry skin;
- Abnormally high body temperature (105.8°F)

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CONFINED SPACE PROGRAM 2004**

If the body temperature rises too high, **death will follow**. The victim should be placed in a shady area, remove outer clothing, wet skin, and increase air movement to improve evaporative cooling. Dial 911 and seek medical assistance for anyone exhibiting these symptoms. No employee should be left alone or sent home without seeking medical attention.

***WARNING***

Heat stroke is life threatening! Summon emergency services **immediately!** The victim should be cooled down with moist cloths and fanning (do not apply ice). Administer fluids if the victim is conscious and will accept them. Do not administer aspirin, medication, alcohol or stimulants (caffeine/cigarettes).

## CLASSIFICATION ALTERNATIVES

### Certification System

The alternate method for managing a permit-required confined space is a certification program. This method can only be used if the City can demonstrate that the only hazard posed by the permit space is an actual or potential hazardous atmosphere, and that continuous forced air ventilation alone is sufficient to maintain the permit space safe for entry.

In order for the space to be considered safe, the atmosphere within the space after ventilation may not be expected to approach a hazardous atmosphere (greater than 10 percent LEL or greater than the PEL for the toxic substance). This is necessary to provide the entrants sufficient time to recognize the hazard and safely exit the space should the ventilation shut down for any reason (such as loss of power).

OSHA recommends using a guideline of 50 percent of the level of flammable or toxic substances that would constitute a "hazardous atmosphere" in order for the space to be considered safe for entry. (E.g. the PEL for chlorine is 0.5 ppm; under this guideline, the measured concentration of chlorine should not exceed 0.25 ppm for it to remain a non-permit space.)

The City is required to develop monitoring and inspection data that supports this determination. If the City must enter the space to collect this information, then entry into the permit space must be conducted using the entry permit system. Once the data is collected, and determinations are made, they are to be made available for review by any employee that enters the space.

### Certification System Requirements

The following requirements must be met for any entry under the certification system:

- Any condition making it unsafe to remove an entrance cover must be eliminated prior to opening the cover;
- Once the cover has been removed, the opening must be guarded by a railing, cover, or barrier to prevent accidental falls or unauthorized entry;
- Prior to entry, the atmosphere must be tested with a direct-reading instrument for oxygen content, flammable gases and vapors, and potential toxic air contaminants;
- The atmosphere in the space must not be hazardous when an employee is in the space;

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

- No employee may enter the space until forced air ventilation has eliminated any hazardous atmosphere;
- Forced air ventilation must be directed to the immediate area where the employee is or will be working and the air supply must be from a clean source;
- The atmosphere in the space is to be tested periodically;
- If a hazardous atmosphere is detected during entry
  - each employee must immediately evacuate the space,
  - the space is to be evaluated to determine the cause of the hazardous atmosphere, and
  - measures must be taken to protect employees from the hazardous atmosphere before re-entry; and
- The City is to certify in writing that all the requirements for a safe entry have been met and this certification is to be made available to each employee entering the space.

**Acceptable  
Atmospheric  
Conditions**

Oxygen	Between 20.1% – 22.0%
LEL	<5%
Carbon Monoxide	<12.5ppm
Hydrogen Sulfide	<5ppm

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## **WARNING**

DO NOT RE-SET THE ALARM POINTS ON THE GAS DETECTORS FOR THIS 50% LEVEL. CONDUCT ROUTINE VISUAL CHECKS OF THE READINGS TO DETERMINE IF THE ATMOSPHERE READINGS IN THE SPACE ARE APPROACHING THE 50% SAFETY LEVELS.

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## **CAUTION**

The use of continuous forced air ventilation to control atmospheric hazards does not constitute elimination of the hazard. Entry into permit spaces where the City has demonstrated that ventilation alone will control the hazards in the space, and there are no mechanical, physical or other recognized serious safety or health hazard, entry can be made under the Certification Program outlined above.

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**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

**Procedures for  
Certifying a Space**

The Program Administrator will review all requests for certifying a permit space as a non-permit space to ensure that the space meets the requirements outlined above. The Program Administrator will develop written safe entry procedures for each reclassified space. The Program Administrator will provide a copy of the safe entry procedures to the Department Head and CSEC for distribution to all affected employees.

Only the Program Administrator may certify a space. No confined space or permit required space will be treated as a certified space until documentation is provided by the Program Administrator.

**Signage for a  
Certified Space**

The CSEC will re-sign all reclassified permit spaces within thirty (30) days of notification with the following language, **“Certified Confined Space – Do Not Enter”**.

**Reclassified  
Spaces**

An existing permit-required confined space that does not contain actual or potential atmospheric hazards can be reclassified as a non-permit space under the following procedures:

- If the permit space poses **no actual or potential atmospheric hazards AND if all the hazards** (mechanical, physical hazards and any other recognized serious safety or health hazard) **can be eliminated without having to enter the space**, the permit space can be reclassified as a non-permit confined space. Methods to eliminate mechanical and physical hazards include lockout/tagout hazardous energy sources, addition of fall protection equipment (full-body harness, tripod with pulley), lighting, etc.
- The evaluation of the hazards must take into account additional sources of hazards (including atmospheric), such as those that result from welding or toxic or flammable cleaning materials, which can be introduced into the space during entry operations.
- If it is necessary to enter the space to eliminate the hazards, the entry must be conducted under the permit entry program outlined above. If testing and inspection during the entry demonstrate that the hazards within the permit space have been eliminated, the permit space can be reclassified as a non-permit confined space for as long as the hazards remain eliminated.
- The basis for determining that all hazards in the permit space have been eliminated must be documented. This documentation is to include the date, the location of the space, and the signature of the person making the determination. This certification is to be made available to all entrants.
- **If hazards arise within a reclassified non-permit space, all entrants must immediately exit the space.** The space must be reevaluated to determine if it must be reclassified as a permit space using the procedures outlined above for the initial reclassification as a non-permit space.



**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

**Procedures for  
Reclassifying a  
Space**

The Program Administrator will review all requests for reclassifying a permit space as a non-permit space to ensure that the space meets the requirements outlined above. The Program Administrator will develop written safe entry procedures for each reclassified space. The Program Administrator will provide a copy of the safe entry procedures to the Department Head and CSEC for distribution to all affected employees.

Only the Program Administrator may reclassify a space. No confined space or permit required space will be treated as a reclassified space until documentation is provided by the Program Administrator. A minimum of 6 (six) months air monitoring data will be collected before a space can be reclassified.

**Signage for a  
Reclassified Space**

The CSEC will re-sign all reclassified permit spaces within thirty (30) days of notification with the following language, **“Reclassified Permit Space - Follow the established safe entry procedures for non-permit entry into this space.”**

**Alternate Entry  
Procedures –  
Certified Spaces**

The following procedures are for entry into permit spaces that the City has demonstrated that the **only hazard** posed by the space **is an actual or potential hazardous atmosphere AND the use of continuous forced ventilation alone is sufficient to maintain the space for safe entry** (maintain acceptable entry conditions). The City is required to provide documented inspection and monitoring data for all of its certified spaces. If there are any additional hazards, such as engulfment, entrapment or any other recognized serious health or safety hazards, then these procedures **cannot** be used -- follow the procedures for permit space entry.

Entry into a certified space does not require a permit or the use of an Attendant. Certain certified spaces will require a buddy system for safe entry. The CSEC AES must approve all entry operations into certified spaces.

- Hazardous atmosphere conditions must be eliminated or controlled prior to entry. Check to see that the mechanical ventilation system is functioning properly;
- Monitor atmosphere around opening of the permit space prior to removing cover or opening space (if possible);
- Promptly guard the opening(s) to the space to prevent unauthorized access to the space;
- Test the internal atmosphere with a calibrated direct-reading instrument prior to entry to ensure that acceptable entry procedures are present.
  - If testing detects a hazardous atmosphere, continue forced air ventilation until all atmospheric hazards are eliminated.
  - Employees are not to enter the space until the forced air ventilation has eliminated any hazardous atmosphere.

**CITY OF TEMPE**  
**CONFINED SPACE PROGRAM 2004**

- The portable forced air ventilation will be directed as to ventilate the immediate areas where an employee is or will be present within the space and will continue until all employees have exited the space.
  - The forced air ventilation will be from a clean source and may not increase the hazards of the space.
- Continuously monitor the atmosphere within the certified space.
- Employees shall immediately leave a certified space if any of the following conditions arise:
  - ⇒ Oxygen reading of less than 20.2% or greater than 21.5%
  - ⇒ LEL reading of 5% or greater
  - ⇒ Any toxic reading greater than 50% of the PEL
  - ⇒ Hydrogen sulfide reading of 5 ppm or greater
  - ⇒ Carbon monoxide reading of 15 ppm or greater
  - ⇒ Chlorine reading of 0.5 ppm or greater
- The space shall be evaluated to determine the cause of the hazardous atmosphere.
- The hazardous atmosphere must be eliminated prior to employees re-entering the space.

**Alternate Entry  
Procedures –  
Reclassified  
Spaces**

- Isolate all non-atmospheric hazards prior to entry using established procedures (e.g., Lockout/Tagout procedures, tripod with full-body harness for fall hazards, approved lighting, clean space to remove wastes or sludge, etc.).
- Use the entry permit to certify that the hazards are eliminated. The certification shall include:
  - Isolation methods used to eliminate the hazards;
  - Location of the space;
  - Date; and
  - Name of person making the determination.
- Immediately exit the space if a hazard develops.
- The space will revert back to a permit space until a new determination is made.
- Note the development of any new hazard on the Comment Section of the permit and forward it to the Permit Review Team.

## NON-ENTRY RESCUE – TRIPOD USE

### **Tripod Use**

A tripod with full-body harness is required for entries into permit spaces with a vertical depth greater than five (5) feet. A mechanical (electric) winch on the vehicle is not to be used since these winches cannot be manually operated in the event of a power failure (i.e., dead battery).

Retrieval systems and lines are designed for remote removal of injured or unconscious entrants. They enable rescuers to conduct a rescue without having to enter the space (Non Entry Rescue). Most systems utilize a tripod and pulley system in conjunction with a full-body harness. The use of body belts (waist belts) is no longer acceptable due to the adverse health effects that can result from their use. A full-body harness is **REQUIRED** for all entry operations, especially in confined spaces with a vertical depth greater than five (5) feet.

It is important to remember that in spaces greater than five feet may present a fall hazard.

### **Tripod Prohibited Use**

The use of Tripod or similar retrieval systems will not be used if it increases the overall risk to the entrants. This includes but is not limited to obstructions or openings in the floor, protruding or points of entanglement or changes in vertical or horizontal directions that would not permit retraction of the entrant.

In addition, a tripod is only designed to be used over an opening and must never be placed on the side (offset) of the space. If the tripod can not be safely placed over the opening, it must not be used.

The Entry Supervisor will determine if a tripod can not be safely used. This decision must be documented on the Permit (Comment Section) before entry operations begin. Upon completion of the entry, the AES will notify the CSEC for their Department and request the PA or designee to perform an assessment of the space.

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

**The use of ropes to manually lower an entrant into or pull an entrant out of a confined space is prohibited.**

**Non-Entry Rescue**

To facilitate non-entry rescue, retrieval systems or methods shall be used whenever an authorized entrant enters a permit space, unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant. Retrieval systems shall meet the following requirements:

1. Each authorized Entrant shall use full body harness, with a retrieval line attached at the center of the entrants back near shoulder level, or above the entrants head. Wristlets may be used in lieu of the chest or full body harness if the City can demonstrate that the use of a full body harness is infeasible or creates a greater hazard and that the use of wristlets is the safest and most effective alternative.
2. The other end of the retrieval line shall be attached to a mechanical device or fixed point outside the permit space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary. **A tripod shall be available to retrieve personnel (wearing a full-body harness) from vertical type permit spaces more than 5 feet (1.52 m) deep.**

If an injured Entrant is exposed to a substance for which a Material Safety Data Sheet (MSDS) or other similar written information is required to be kept at the worksite, that MSDS or written information shall be made available to the medical facility treating the exposed entrant.

**Rescue Teams**

For the purpose of rescue services, the City of Tempe will use the Tempe Fire Department. The Program Administrator will provide a list of confined spaces to the Tempe Fire Department for review.

During entries where a retrieval system can not be used because it will increase the overall risk to the Entrant, the Program Administrator and/or Environmental Health and Safety Section will be notified prior to entry operations.

In 1986 NIOSH issued an alert that stated rescuers accounted for more than 65 percent of confined space fatalities. If the City allows employees to enter spaces to perform rescue services:

1. The City shall ensure that each member of the rescue service is provided with, and is trained to use properly, the personal protective equipment and rescue equipment necessary for making rescues from permit spaces.
2. Each member of the rescue service shall be trained to perform the assigned rescue duties. Each member of the rescue service shall also receive the training required of authorized entrants under §1910.146(g).

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

3. Each member of the rescue service shall practice making permit space rescues at least once every 12 months, by means of simulated rescue operations in which they remove dummies, mannequins, or actual persons from the actual permit spaces or from representative permit spaces. Representative permit spaces shall, with respect to opening size, configuration, and accessibility, simulate the types of permit spaces from which rescue are to be performed.
4. Each member of the rescue service shall be trained in basic first aid and in cardiopulmonary resuscitation (CPR). At least one member of the rescue service holding current certification in first aid and in CPR shall be available.

In the event the City arranges to have persons other than the City's Fire Department personnel perform permit space rescues, the City shall:

1. Inform the rescue service of the hazards they may confront when called on to perform rescue at the City's facility, and
2. Provide the rescue service with access to all permit spaces from which rescue may be necessary so that the rescue service can develop appropriate rescue plans and practice rescue operations.

**Hot Work  
Activities**

## HOT WORK PERMITS

Hot work is a term that describes all work operations that are capable of **generating heat** or providing a **source of ignition**.

Operations that are considered hot work include, but are not limited to;

- Welding,
- Cutting with torches or open flames,
- Hot riveting & forging,
- Portable electrical tools,
- Grinding, drilling,
- Soldering,
- Sandblasting,
- Sparks from hand tools (chisels, etc.).

Whenever any of these operations are conducted in a confined space, a **hot work permit** is required. The hot work permit is a checklist of precautions to be followed before conducting any hot work operations and a list of safety guidelines to be followed while conducting hot work operations. The key feature of the hot work permit is the requirement that a trained fire watch person be present during all hot work operations. The name of the person assigned as the fire watch is to be noted on the hot work permit. The person assigned as the fire watch shall sign the hot work permit after verifying, through the use of the checklist on the hot work permit, that all necessary safety precautions have been taken. The fire watch sign-off includes ensuring that the:

- Work area has been inspected; and
- Work area as been found to be safe.

A suitable fire extinguisher shall be present during all hot work operations. The need for a hot work permit shall also be noted on the entry permit by the AES prior to authorizing entry to begin.

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

**Hot Work  
Procedures**

When practicable, all combustible materials will be removed from the space. When this is not possible, combustible material will be protected with flame proof material (covers), shielded with metal, curtains, or wetted down to prevent ignition of the material.

When cutting, welding, soldering or brazing is performed near walls, partitions, ceilings or roof of combustible construction, it will be protected with flame proof material (covers), shielded with metal, curtains, or wetted down to prevent ignition of the material.

When hot work operations are suspended for any substantial period of time (lunch overnight) the following equipment will not be left in a confined space:

- All electrodes will be removed from arc welding devices and placed outside the space. The machine will be disconnected from the power sources.
- Torch valves will be closed and gas supply closed at the tanks. All hoses shall be removed from the space.
- No fuel, oxygen or inert gas tanks shall be placed inside any confined space without written approval by the Program Administrator.

**Fire Watch Person**

Fire watch person will be provided during the entry and ½ hour past the completion of the hot work being performed.

**Prohibited  
Conditions**

Hot work activities will not be performed in the following situations:

- In areas not authorized by the Program Administrator;
- In buildings where fire protection has been turned off or is not functioning;
- In areas with potentially explosive and/or flammable atmospheres;
- In areas in close proximity to the storage of exposed, readily ignitable materials; or
- In areas where there is dust accumulation of greater than 1/16 inch deep within 35 feet of the area where hot work will be conducted.

## CONTRACTORS

OSHA's final rule for "Permit Required Confined Spaces for General Industry; under 29 CFR, Part 1910, Section 146, exempts certain industries from these regulations since they are covered under their own specific regulations. These industries include:

- Agriculture;
- Construction; and
- Shipyard employment

OSHA feels that its existing construction standards contain requirements for dealing with confined space hazards in underground construction and in underground electrical transmission and distribution work (29 CFR 1926 Subpart S and §1926.956, respectively). The City is required under OSHA's General Duty Clause (§5(a)(1)) to provide a safe work environment for its employees.

**Therefore, the City will require its contractors and their subcontractors, to implement OSHA's Permit-Required Confined Space Entry Program (§1910.146) for all projects on city-owned property or facilities, especially in excavation projects that exceed a depth of four (4) feet. The intent of this requirement is to protect City employees (such as inspectors, project managers, etc.).**

### **City Requirements to Contractors**

When the City arranges to have employees of another company perform work that involves permit space entry, the CSEC for that work group will:

- (i) Inform the contractor that the workplace contains permit spaces and that permit space entry is allowed only through compliance with a permit space program meeting the requirements of this section;
- (ii) Apprise the contractor of the elements, including the hazards identified and the City's experience with the space, that make the space in question a permit space;



**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

- (iii) Apprise the contractor of any precautions or procedures that the City has implemented for the protection of employees in or near permit spaces where contractor personnel will be working;
- (iv) Coordinate entry operations with the contractor, when both City personnel and contractor personnel will be working in or near permit spaces, as required by §1910.146(d)(11); and
- (v) Debrief the contractor at the conclusion of the entry operations regarding the permit space program followed and regarding any hazards confronted or created in permit spaces during entry operations.

**Contractor  
Responsibilities**

Contractors will submit to the Program Administrator a copy of their written program and proof of training prior to commencement of entry operations. In addition, to complying with the permit space requirements that apply to the City, each contractor who is retained to perform permit space entry operations on behalf of the City will:

- (i) Obtain any available information regarding permit space hazards and entry operations from the City;
- (ii) Coordinate entry operations with the City, when both City personnel and contractor personnel will be working in or near permit spaces, as required by §1910.146(d)(11); and
- (iii) Inform the City of the permit space program that the contractor will follow and of any hazards confronted or created in permit spaces, either through a debriefing or during the entry operation.

**Construction  
Projects**

When any City employee is required to enter a confined space during the construction phase of a project, such as for the purpose of inspection, the City of Tempe employee is required to follow the City's Confined Space Entry Program. This requirement is to ensure that City employees are adequately protected from potential confined space hazards.

It is the responsibility of the contractor to provide a trained attendant<sup>5</sup> and all necessary equipment required for safe entry. This will include, but is not limited to:

- Calibrated, direct-reading atmospheric monitor;
- Tripod with mechanical winch, full-body harness;
- Mechanical ventilation unit with hose;
- Communication devices to summon rescue personnel;

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<sup>5</sup> Training is to include, as a minimum, the requirements set forth in OSHA's Permit-Required Confined Space Program, hazard recognition and mitigation techniques, proper use and care of air monitoring equipment and emergency rescue procedures.

**CITY OF TEMPE  
CONFINED SPACE PROGRAM 2004**

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# HOT WORK PERMIT

**This Permit is required for any temporary operation which involves open flames, produces heat and/or sparks. Operations include but are not limited to:**

- **Brazing**
- **Grinding**
- **Thawing Pipe**
- **Welding**
- **Cutting**
- **Soldering**
- **Torch Applied Roofing**

Name of Site:			
Address of Site:			
Specific Location:			
Description of Hot Work:			
Is the Hot Work being performed inside a confined space:		Yes No	(Attach to Confined Space Permit)
Is there a contractor performing work:	Yes No	If Yes, Name	
<b>Instructions</b>			
<b>1. Supervisor responsible for area and/or employees performing Hot Work Signs this Permit only <u>after</u> assigning specific duties as identified below.</b>			
<b>2. Verify Precautions listed on the checklist below.</b>			
<b>3. City employee retains original Hot Work Permit.</b>			
<b>4. Issue duplicate of Hot Work Permit to Journeyman.</b>			
<b>5. After completion, forward copy of Hot Work Permit to the Environmental, Health and Safety Section within seven (7) days.</b>			
<b>Assignments</b>			
Hot Work Being Performed By: (Print)		Signature	
Name of Fire Watch: (Print)		Signature	
I verify that the above location has been examined to prevent fire (checklist), the person performing the hot work is competent and the person assigned to fire watch has been trained in their specific duties. I hereby authorize permission to perform Hot Work.			
Supervisor (Print)		Signature	
Date Started:		Time Started:	
Time Completed:		Fire Watch Ended:	

**IF PRECAUTION CHECKLIST IS NOT VERIFIED OR PRECAUTIONS  
CAN NOT BE MADE SAFE  
DO NOT PROCEED!**



# HOT WORK PERMIT

## CHECKLIST

- ☐ Fire hoses and/or fire extinguishers are present and operable.
- ☐ Hot Work equipment is good condition.

### REQUIRMENTS WITHIN 35 FEET OF WORK

- ☐ Flammable liquids, dust, lint and oily deposits are removed.
- ☐ Explosive atmosphere in area eliminated.
- ☐ Floors clean.
- ☐ Combustible floors wet down and covered with damp sand or fire-resistant tarps or metal shields.
- ☐ All walls and floor openings covered.

### WORK ON WALLS OR CEILINGS

- ☐ Construction is noncombustible and without combustible covering or insulation.
- ☐ Combustibles on other side of walls moved away.

### WORK ON ENCLOSED EQUIPMENT

- ☐ Enclosed equipment cleaned of all combustibles.
- ☐ Containers purged of flammable liquids and/or vapors.

### FIRE WATCH MONITORING

- ☐ Fire watch supplied with suitable extinguisher.
- ☐ Fire watch trained in the use of required equipment, sounding alarm and summoning Fire Department.

***Fire watch must observe the site a minimum of thirty minutes (30) after hot work is completed. Fire watch must sign off after work is completed and the site is found to be safe.***

<b>Fire Watch</b> (Print)		<b>Signature</b>	
Time Hot Work Completed:		Fire Watch Ended:	



# CONFINED SPACE ENTRY PERMIT

Name of Site:			
Address of Site:			
Description of Work:			
Authorized By (AES Print)		Signature	
Date Opened		Time Opened	
Authorized Attendant(s)			
Print Name		Signature	
Authorized Entrants(s)			
Print Name		Signature	
Potential Space Hazards (Check All That Apply)			
<input type="checkbox"/>	Oxygen Deficiency <19.5%	<input type="checkbox"/>	Flammable gases/vapors >10% LEL
<input type="checkbox"/>	Oxygen Enriched >23.5%	<input type="checkbox"/>	Toxic gases/vapors greater than PEL
<input type="checkbox"/>	Mechanical/Pneumatic/Hydraulic (Circle Hazard)	<input type="checkbox"/>	Electrical Hazards
<input type="checkbox"/>	Corrosive	<input type="checkbox"/>	Engulfment
<input type="checkbox"/>	Fall Hazard	<input type="checkbox"/>	Heat/Cold/Humidity (Circle Hazard)
<input type="checkbox"/>	Traffic	<input type="checkbox"/>	Noise
<input type="checkbox"/>	Lighting	<input type="checkbox"/>	
<input type="checkbox"/>	Other (Describe)		
<input type="checkbox"/>			
Equipment Required For Entry Work (Check All That Apply)			
<input type="checkbox"/>	SCBA (List Contaminants)		
<input type="checkbox"/>	Tripod – Lifeline	<input type="checkbox"/>	Harness
<input type="checkbox"/>	Eye Protection (Type)	<input type="checkbox"/>	Hand (Type)
<input type="checkbox"/>	Foot (Type)	<input type="checkbox"/>	Hearing (Type)
<input type="checkbox"/>	Garment (Type)	<input type="checkbox"/>	Ventilation (Type)
<input type="checkbox"/>	Communications (Type)	<input type="checkbox"/>	Gas Detector
<input type="checkbox"/>	Escape Bottle	<input type="checkbox"/>	
<input type="checkbox"/>	Non-Entry Rescue Equipment (Type)		
<input type="checkbox"/>	Other (Describe)		
<input type="checkbox"/>			
Pre-Entry Procedures (Check All That Apply)			
<input type="checkbox"/>	Pre-Entry Checklist	<input type="checkbox"/>	Ventilation (Mechanical – Natural)
<input type="checkbox"/>	Entry Point Into Space Barricaded	<input type="checkbox"/>	Time:
<input type="checkbox"/>	Lockout/Tagout – De-Energized Equip.	<input type="checkbox"/>	Mechanical/Pneumatic/Hydraulic Isolation
<input type="checkbox"/>	Hot Work Permit	<input type="checkbox"/>	Lighting (UL/FM Approved)
<input type="checkbox"/>		<input type="checkbox"/>	Traffic Control



<u>Telephone Number</u>	
Tempe Fire/Police	<b>911</b>
Tempe St. Luke's Hospital	784-5656
Water Utilities Control Center	350-2669
Environmental Health and Safety	858-2223

# EMERGENCY 911



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